

Surface Leakage Suppression in LWIR Type-II Superlattice Photodetectors Using Electrical Gating Technique, Phase I

Completed Technology Project (2013 - 2013)



Project Introduction

High performance LWIR detectors are highly needed. In order to image from long distance, it is important that imagers have high sensitivity, high resolution, and very low dark currents. This leads to technical goals of having low noise, low dark current in small size pixels in large arrays. While saturated performance levels of traditional systems based on bulk semiconductors have not quite met the requirement of applications, it is expected that novel quantum systems will bring new development stage for infrared imagers. In recent years, Type-II InAs/GaSb superlattice (T2SL) has experienced significant development, from theoretical modeling, material growth to device processing and packaging. Performance of LWIR detector based on T2SL has become comparable, even better than that of HgCdTe. However, LWIR T2SL devices have been shown to be limited by surface leakage, especially at lower operating temperature. This proposed effort will investigate gating of Type-II photodiodes as a means to suppress this bottle neck of T2SL technology. The ultimate goal of this project is to develop an effective method to completely suppress the surface leakage current in LWIR type-II superlattice photodiodes that is compatible with the development of high performance gated FPAs in Phase II.

Primary U.S. Work Locations and Key Partners

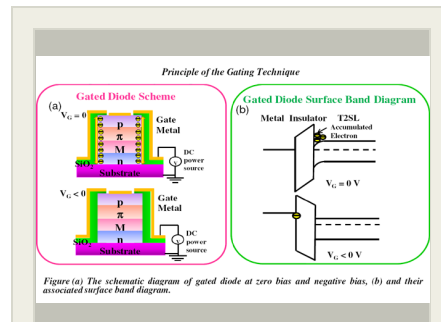
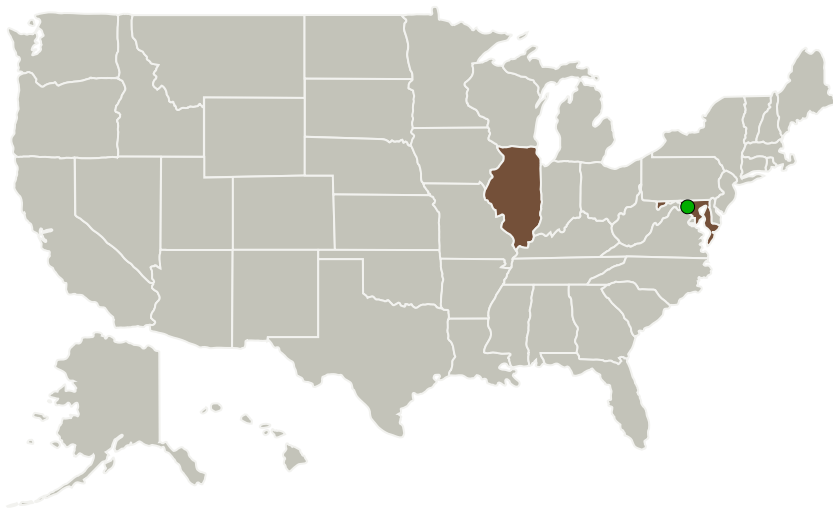


Figure (a) The schematic diagram of gated diode at zero bias and negative bias, (b) and their associated surface band diagram.

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Organizations Performing Work	Role	Type	Location
MP Technologies, LLC	Lead Organization	Industry	Evanston, Illinois
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Illinois	Maryland
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Project Transitions

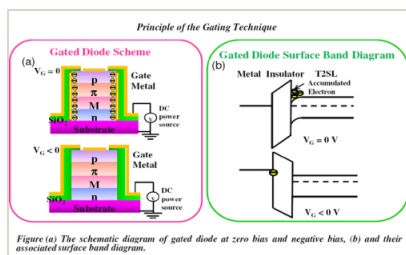
▶ **May 2013:** Project Start

✓ **November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138580>)

Images



Project Image

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(<https://techport.nasa.gov/image/126522>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MP Technologies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

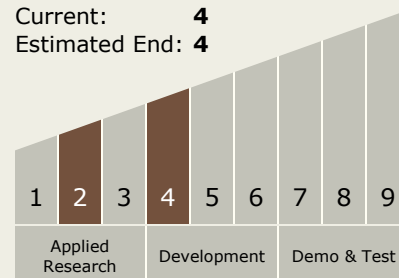
Carlos Torrez

Principal Investigator:

Ryan McClintock

Technology Maturity (TRL)

Start: 2
Current: 4
Estimated End: 4



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Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.3 In-Situ Instruments and Sensors
 - └ TX08.3.1 Field and Particle Detectors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System